

## CLAIMS:

1. An encoding apparatus for two-dimensionally encoding user data of a user data stream into channel data of a channel data stream along a two-dimensional channel strip of at least two bit rows one-dimensionally evolving along a first direction and being aligned with each other along a second direction, said two directions constituting a two-dimensional  
5 lattice of bit positions, said apparatus comprising  
a modulation code encoder for modulation code encoding said user data into said channel data according to a two-dimensional modulation code being adapted to prevent predetermined worst case patterns of channel data in said channel data stream.
- 10 2. An encoding apparatus claimed as in claim 1,  
wherein said worst case pattern include local periodic patterns having fundamental frequency components outside the circle formed by the base of the two-dimensional optical modulation transfer function.
- 15 3. An encoding apparatus claimed as in claim 1,  
wherein said worst case patterns include patterns forming a closed ring of bit symbols having alternating bit values or form an open ring of bit symbols having alternating bit values at a boundary of said channel data stream where the opening of the ring is at the side of the  
20 boundary.
4. An encoding apparatus as claimed in claim 1,  
wherein said modulation code encoder comprises a state-transition machine for prevention of said worst case patterns by checking the building up of a worst case pattern during  
modulation code encoding and by truncating a sequence of channel words building up the  
25 start of a worst case pattern by entering a state of the encoding apparatus and its state-transition machine that forbids the emission of a NRZ channel symbol that leads to a further continuation of the worst case pattern.

5. An encoding apparatus as claimed in claim 4,  
wherein said state-transition machine comprises a state conversion unit for putting said finite-  
state-machine into a new state generated depending on said NRZ channel symbol and the  
current state of said state-transition machine together with encoding a user word into a  
5 channel word, said generation method being based on an extended state-transition diagram  
having a number of STD-states comprising at least one pair of STD-states having an identical  
fan-out except for NRZI channel symbols that lead to a next NRZ channel symbol of a worst  
case pattern.
- 10 6. An encoding apparatus as claimed in claim 1,  
wherein said modulation code encoder comprises a channel word conversion unit for  
transcoding the NRZ channel symbols into NRZI channel symbols by a one-dimensional 1T-  
precoding operation including an integration modulo 2, said 1T-precoding operation being  
carried out along said one-dimensional direction of infinite extent.
- 15 7. An encoding apparatus as claimed in claim 1,  
wherein said modulation code encoder is adapted for implementing a radial and/or tangential  
k-constraint by adding further STD-states in said state transition diagram having no fan-out  
for predetermined NRZI channel symbols.
- 20 8. An encoding apparatus as claimed in claim 1,  
wherein said modulation code encoder is adapted for use of enumerative encoding for  
modulation code encoding.
- 25 9. An encoding apparatus as claimed in claim 1,  
wherein said modulation code encoder is adapted for implementing a high-rate code, in  
particular a 152 to 153 code.
- 30 10. An encoding apparatus as claimed in claim 1,  
wherein the NRZI channel bits are arranged on the lattice points of a square or hexagonal  
lattice.
11. An encoding method for two-dimensionally encoding user data of a user data  
stream into channel data of a channel data stream along a two-dimensional channel strip of at

least two bit rows one-dimensionally evolving along a first direction and being aligned with each other along a second direction, said two directions constituting a two-dimensional lattice of bit positions, said method comprising the step of modulation code encoding said user data into said channel data according to a two-dimensional modulation code being adapted to prevent predetermined worst case patterns of channel data in said channel data stream.

12. Computer program comprising program code means for causing a computer to perform the steps of the method as claimed in claim 11 when said computer program is executed on a computer.

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13. Record carrier comprising two-dimensionally encoded user data of a user data stream into channel data of a channel data stream along a two-dimensional channel strip of at least two bit rows one-dimensionally evolving along a first direction and being aligned with each other along a second direction, said two directions constituting a two-dimensional lattice of bit positions, said method comprising the step of modulation code encoding said user data into said channel data according to a two-dimensional modulation code being adapted to prevent predetermined worst case patterns of channel data in said channel data stream.

14. Record carrier as claimed in claim 13 characterized in that said worst case pattern include local periodic patterns having fundamental frequency components outside the circle formed by the base of the two-dimensional optical modulation transfer function.

15. Record carrier as claimed in claim 13 characterized in that said worst case patterns include patterns forming a closed ring of bit symbols having alternating bit values or form an open ring of bit symbols having alternating bit values at a boundary of said channel data stream where the opening of the ring is at the side of the boundary.

16. Record carrier as claimed in claim 13 characterized in that the user data is encoded using a high-rate code, in particular a 152 to 153 code

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17. Record carrier as claimed in claim 13 characterized in that the channel data comprises NRZI channel bits arranged on the lattice points of a square or hexagonal lattice.